# Engineering and **environmental**

To the casual observer, the construction project on the road that crosses Phinney's Bay and leads to Dowse's Beach in Barnstable, Mass., probably looked like nothing more than another road repair effort in advance of the busy Cape Cod tourist season. In reality, the project had implications on infrastructure replacement and environmental improvement that resonate with public works departments throughout Massachusetts and across the country.

The ostensible goal of the Phinney's Bay project is to replace two concrete pipes beneath the beach access road with a precast concrete box culvert. The impetus, however, is not just infrastructure that is failing or in disrepair—the primary driver of the project is to improve the environmental quality of the upstream wetlands area that has been degraded by restricted tidal flow.

"There's a real push in the state of Massachusetts to do salt marsh restoration projects," said John Jacobsen, public works director for Barnstable. "It results from undersized pipes that choke off the flow to the salt marsh. The water quality has been severely degraded over time."

Projects like the one in Phinney's Bay are happening all over Massachusetts, in other coastal states, and even in inland states for the purpose of restoring wildlife habitats degraded by river crossings. What many public works departments may not be aware of is that they are not the only entities interested in replacing the infrastructure. Projects like this represent a unique partnership opportunity among local entities, conservation boards, and state and federal agencies—and forging those bonds to pursue them could potentially open previously untapped sources of funding.

## SUCCESS ON TWO FRONTS

It's a chicken-or-the-egg kind of problem, but the right solution can have unforeseen benefits for everyone involved: A public works department determines that a culvert is approaching the end of its usefulness. Meanwhile, the state's conservation department independently determines that the marsh area the culvert feeds has a tidal restriction that's degrading the water quality and threatening the habitat. In both cases, the solution is that the culvert needs to be replaced.

The question is, which came first? The answer is that it doesn't matter—and in fact, the ideal scenario is that both situations get discovered simultaneously, and the different entities collaborate on a mutually beneficial solution.

"Because there often is environmental degradation associated with these crossings, there are resources available to help towns fix these problems," said Hunt Durey, manager of the Wetlands Restoration Program (WRP) of the Massachusetts Office of Coastal Zone Management. "There's a tremendous opportunity associated with infrastructure repair and replacement projects nationwide to achieve a win-win scenario of infrastructure improvement and environmental restoration."

The mission of the WRP (www.mass.gov/czm/wrp) is to prompt any and all entities involved in coastal zone infrastructure projects—from public works departments to conservation managers to state and federal agencies—to work together to find that win-win scenario. "We work with DPWs (departments of public works) and many other partners to proactively restore

The existing concrete pipes under the road to Dowse's Beach in Barnstable, Mass., were too small, leading to degraded water quality in Phinney's Bay. The restoration project called for installation of a 4x10-foot precast concrete box culvert under the beach road to restore tidal flow to the area. Photos: Horsley Witten Group

# equilibrium

*Culvert replacement can yield untapped resources and unplanned benefits*

degraded wetlands," said Durey. "The proactive part is important, because it's all voluntary—none of them are tied to development. The vast majority of the projects focus on marshes that are restricted by undersized culverts."

In essence, the WRP acts as the facilitator for such projects, available to help forge partnerships, secure funding, oversee project planning and implementation, and conduct community education and outreach on behalf of any project in the state's coastal zone that falls under its mission.

For public works departments, the WRP could be especially helpful in helping locate and secure funding, said Durey. The group has close ties to federal agencies like the U.S. Fish and Wildlife Service, the U.S. Army Corps of Engineers, the National Oceanic and Atmospheric Administration, and many others, not to mention dozens of state and local agencies. "Often, the majority of funding to replace a culvert can be obtained from outside sources," said Durey.

The WRP also publishes a Coastal Tidal Restriction Atlas to help towns determine where problems exist in their region. The group can be a resource for public works departments in other ways as well, said Durey, by providing technical guidance and helping towns secure the right kinds of permits for their projects—particularly if the towns are not initially aware that in addition to the infrastructure replacement, their project also has environmental implications.

"We strongly encourage DPWs and other town officers to contact our program when they have a question about whether a culvert is tidally restrictive," said Durey. "If they don't know, it can cause permit problems. They may be required to go back and include the restoration."

## FIXING THE BAY

The Phinney's Bay project in Barnstable is one of several recent projects of this type in the region. (The WRP has been involved in other projects in Barnstable but was not directly involved in the Phinney's Bay initiative, said Durey.) According to Jacobsen, the projected cost of the project was $260,000 and it was funded by a variety of sources, including federal grants.

In Phinney's Bay, the public works department replaced two concrete pipes under the beach access road with a 32-foot-long, 4x10-foot precast concrete box culvert. That size was decided on based on a cost/benefit analysis to determine what would produce balanced flushing and optimum salinity levels in the bay, said Rich Claytor, principal with Horsley Witten Group, the Sandwich, Mass.-based environmental engineering firm contracted for Phinney's Bay and several other culvert replacement projects.

"We try to come up with an optimum size and geometry based on cost," said Claytor. "We put pressure transducers in the water to measure the elevation for a month to record the average

tides—to get a range of what the tide is doing upstream and downstream. Then we model the existing opening using a variety of different culvert capacity software."

Horsley Witten helped the Barnstable public works department conduct the feasibility study for the effort, determine the culvert size and design, and helped secure local, state, and federal permits for the project, Claytor said.

"We also had to build a temporary culvert adjacent to the permanent structure to allow tidal exchange during construction," said Claytor. "That adds cost, but if you have critters living in the embayment, they need tidal exchange to survive."

Other important considerations for Phinney's Bay were location and timing, particularly given the time of year. "This road goes out to a coastal beach access, so it's very popular," said Claytor. "We have to get the road back open for beach season."

## CONSERVATION COLLABORATION

Durey of the WRP is familiar with the challenges faced at the local level, having worked as a local conservation agent prior to joining the state. He knows that local level infrastructure improvement and state and federal conservation efforts don't always gel, and his aim is to make sure that through proper planning, those groups connect on projects like these.

"Historically, there has been a disconnect between those efforts," said Durey. "The opportunity really lies in advance planning—for the transportation and the restoration people to work enough in advance to plan these projects in collaboration."

Part of what the WRP can offer is outreach to towns, helping educate the community on the advantages of these types of projects. "Typically there is community support for the project, because the benefits are tremendous," he said. "The impact to the marsh and the aquatic habitat are really dramatic, and most towns are very supportive."

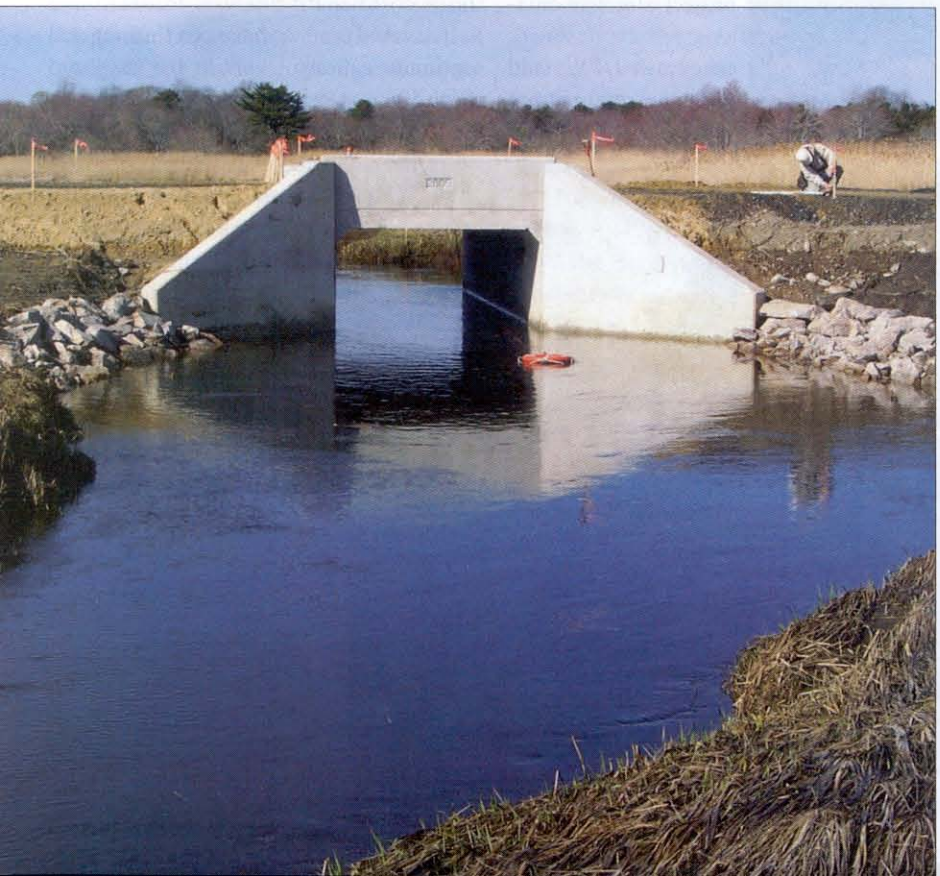
Durey's group also works with public works departments to address logistical issues, including those raised by closed roadways and rerouted traffic. "That can sometimes raise complaints, so we work closely with the town to figure the best time to do their project," he said.

One of the WRP's sister programs, the Massachusetts Riverways Program, has developed a model for successful outreach and education on inland projects. The River Continuity Partnership addresses culvert replacements in freshwater river environments and improved design for fish wildlife passage. That group developed a stream-crossing handbook and poster to educate DPWs about the importance of properly designed crossings. The materials are available on the organization's Web site at www.mass.gov/dfwele/river.

"We have done similar outreach work with local DPWs," said Durey. "We're working on a DPW handbook that provides a good overview of the benefits that can be attained."

For Durey and the WRP, the overall goal is to meld the goals of two distinct groups that may not be aware of one another, but share a common goal.

"Lots of legacy infrastructure exists that was built in the last 20 to 30 years without understanding about the environmental impact," said Durey. "All this infrastructure has to get replaced. The opportunity I see is a real teaming up of infrastructure replacement and environmental restoration. You're achieving dual results—it's an amazing opportunity." **PW**



**The Bridge Creek restoration project in Barnstable replaced culverts beneath an active railroad line and an adjacent major state road, Route 6A. The new culvert restored tidal flow to 40 acres of salt marsh area. Photos: Wetlands Restoration Program**